Renewable Specialty Chemical Working Group White Paper

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Sustainable chemistry produces green chemicals from renewable raw materials using environmentally friendly processes that not only conserve energy and water but also have a low carbon footprint. The primary technology-driver for sustainable chemistry is biotechnology and the main input is plant-derived raw materials. Importantly, sustainable chemistry allows U. S. companies to replace raw materials derived from foreign oil with agricultural materials produced domestically.

Why does sustainable chemistry make sense for America? We live in a competitive world. U.S. companies can create rewarding high-paying jobs for Americans, if government supports new industries in which the U.S. can maintain a leadership position. Sustainable chemistry is a sector where U.S. companies are positioned to lead because it combines three areas of U.S. strength: biotechnology, agriculture and chemicals. First, the U.S. has been and continues to be a world leader in biotechnology- its companies and research institutions excel in the core capabilities required by this industry: protein engineering, metabolic engineering and synthetic biology. Second, the American farmer has an unparalleled ability to produce the raw material needed by this industry. Finally, the U.S. has the world's largest national chemical industry. Ten cents of every U.S. export dollar is derived from chemical sales. The value of America's share of the global chemical market is $690 billion (19% of the $3.7 trillion dollar global market). The chemical industry directly employs 860,000 people in the U.S., and indirectly supports the employment of another 4,795,500 people.

Why switch from "traditional chemistry" to "sustainable chemistry"? Although the U.S. chemical industry remains successful, several forces have reshaped the global chemical industry over the past decade. Among these is growth of the industry in the Middle East and Asia. Consider, for example, Dow Chemical's decision to exit the commodity chemical business in 2007. According to Dow's CEO, Andrew Liveris: "Petrochemicals will be looked at from the point of view of low-cost feed stocks; given the likelihood that energy and feedstock costs will remain high by historical standards, there is every reason to believe that productive assets will continue to gravitate to regions that offer advantaged feed stocks, namely, the Mideast and Asia." Over the past decade, U.S. direct employment in the chemical sector has decreased from 992,000 to 860,000 employees. Regarding exports, the U.S. enjoyed a trade surplus of $13.4 billion in 1998, but by 2008 the sector suffered a trade deficit of -$2.7 billion. We believe that the U.S. can reverse these trends by capitalizing on its core strengths in biotechnology, agriculture and chemical manufacturing. While the traditional U. S. chemical industry is shrinking, several independent groups have estimated that the global sustainable chemistry industry will grow to $1 trillion dollars. This creates a significant opportunity for job growth and export growth because the current global sustainable chemistry industry is only about 7% of its projected future size. If U.S. companies can capture 19% of this new $1 trillion market, (by analogy to the traditional chemical industry) we project that the U.S. will create about 237,000 direct U.S. jobs in the sustainable chemistry sector, while shifting the balance of trade in the chemical sector to a trade surplus.

The traditional chemical industry is made up of two broad sectors: commodity chemicals and specialty chemicals. Each plays critical but different roles. Commodity chemicals are manufactured in large quantities, sell for a low price and provide the base volume for the industry. However, they are cyclic and have wide swings in prices and margins across the commodity cycle. Specialty chemicals in contrast have smaller volumes and higher margins. Their role is to provide higher margins that are consistent across the commodity cycle.

Like the traditional chemical industry, the sustainable chemistry industry of the future will have two product sectors: commodity biochemicals (also known as bioproducts) and specialty biochemicals. Both will play critical yet different roles in the integrated biorefinery. Commodity biochemicals like biofuels will

provide a base of large volume, low margin business. However, both commodity biochemicals and biofuels are subject to the volatility of commodity cycles. Specialty biochemicals will provide a base of consistent, non-cyclic higher margin products that can be depended upon across the commodity cycle and offer a stable cash-flow during biofuels and commodity chemical troughs.

What is required to accelerate the development of a strong specialty biochemical sector? Three factors are currently limiting the growth of specialty biochemical sector. The first is a lack of research funding to support early stage development of new specialty biochemical technology platforms and products. For many years, the US DOE has provided significant research support for both biofuels and commodity biochemicals which has greatly accelerated the development of these products. Over the past 15 years, the DOE and USDA have provided significant financial support for the development of cellulosic and third generation biofuels. Their support greatly accelerated the development of these new fuel alternatives. Commencing in 2004, the DOE and USDA expanded their support of biofuels to include support for the development of 12 commodity biochemicals which have had a significant impact on their advancement.

Authorizing consistent annual research funding specifically for specialty biochemicals will encourage them to expand their focus to specialty biochemicals which will greatly accelerate and expand the pipeline of new products

While biofuels and commodity biochemicals have benefited from extensive research grant support, there has been very little research support for specialty biochemicals. Thus, universities, research institutions and industry have focused on developing new biofuels and commodity chemicals. Authorizing consistent annual research funding specifically for specialty biochemicals will encourage them to expand their focus to specialty biochemicals which will greatly accelerate and expand the pipeline of new products.

Access to loan guarantees and grants will help address the lack of capital to fund the transition from pilot-scale production to full-scale manufacturing

The second factor limiting the growth of the specialty biochemical sector is the cost of investing in manufacturing capacity. It is often said that there is a “valley of death” that must be crossed in order to make the transition to full-scale manufacturing. Access to loan guarantees and grants will help address the lack of capital to fund the transition from pilot-scale production to full-scale manufacturing.

A production credit for qualifying specialty biochemicals products during the first five years will provide the incentive to accelerate market growth

The third is the initial product costs due to a lack of economy of scale during the initial years of launching a product. Initially, when a specialty biochemical is first commercialized, sales volumes are low and due to the lack of economy of scale, costs are high. After several years as the product is successfully adopted by the market, volumes increase, costs drop and the product becomes profitable. A production credit for qualifying specialty biochemicals products will provide the incentive to accelerate market growth.